UNIVERSAL COUNTER
MODEL:GUC-2010

INSTRUCTION MANUAL

GW GOOD WILL INSTRUMENT CO., LTD.

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1. GENERAL INFORMATION

The model GUC-2010 UNIVERSAL COUNTER is the newest result of the continuing low cost counter product development effort. It combines excellent performance and traditional GW quality at a very attractive price. This counter is designed to deliver reliable, high quality operation in such areas as: Production Test, Frequency, Monitoring, Education, Training, Laboratory, Service and Calibration.

This instrument features all the basic functions required for a variety of measurements: frequency, frequency ratio, period, time interval, and totalize.

1-1 Features

*Low Cost, High quality.
*Highly accurate and stable timebase.
*SN74S196 ultra-high-speed schottky-clamp TTL for presetable counter.
*High sensitivity.
*Electronic switches provide FUNCTION and Gate Time change for easy operation.
*Compact, light weight
*Low power consumption.

2. SPECIFICATIONS:

2-1 Frequency Measurements (CHA ONLY)

Range	: 5Hz to 100MHz
Gate time	: 10mS, 0.1Sec. 1, Sec, 10 Sec in 4 decade steps.
Resolution	: 100Hz, 10Hz, 1Hz, 0.1Hz
Accuracy	: ±(Time base accuracy + 1 count).
Read Out	: KHz, displayed with decimal point

2-2 Period Measurements (CHA ONLY)

Range	: 0.04uS to 10 Sec.
Frequency Range	: 5Hz to 25MHz
Resolution	: 0.1nS to 0.1uS in 4 decade steps (10MHz Range) 0.01nS to 0.01uS in 4 decade steps (100MHz Range)
Accuracy	: ±1 count ± time base accuracy ± trigger error of signal.
Read Out	: uS displayed with decimal point

2-3 Totalize Measurements (CHA ONLY)

Range	: 5Hz to 10MHz
Count Capacity	: 99999999.
Display	: Total count, no decimal or annuncitor.

2-4 Ratio Measurements

Display	: f1/f2, where f1 and f2 are applied at input channels A and B respectively.
Range	: CHA: 5Hz to 100MHz (f1) CHB: 5Hz to 25MHz (f2)
Accuracy	: ±1 count of signal on CHA + trigger error of signal on CHB.
Readout	: Decimal point without unit annunciation.

2-5 Time Interval Measurements

Range	: 0.4uS to 10Sec
Input:	: Channels A and B
Resolution	: 100nS to 0.1mS in 4 decade steps.
Accuracy	: ±1 count ± time base accuracy ±1 trigger error.
Readout	: uS displayed with decimal point.

2-6 General

Input Sensitivity	: CHA 20mVrms to 100MHz CHB 20mVrms to 25MHz
Input Impedance	: CHA or B 1MΩ NOMINAL shunted by less than 30pF.
Attenuator	: 1/1, 1/10 NOMINAL (CHA only)
Check	: Counts internal 10MHz oscillator.
Display	: 8 digit amber LED display with gate time, function, uS, KHZ and OVERFLOW indication.
Operation temperature	: 0° to 50°C.
Storage temperature	: -55°C to 75°C.

Time Base : Aging Rate ± 1 x 10^{-6} /Month
Temp. Stability 25°C ± 5°C ±5 x 10^{-6}
0°C – 50°C ±2 x 10^{-5}
*Special order made (TCXO) GUC-2010S
Aging Rate ±1 x 10^{-7} /Month
Temp. stability 25°C ± 5°C ±5 x 10^{-7}
0°C – 50°C ±2 x 10^{-6}

Max. Input Voltage	: CHA and B 250Vmax. dc + ac peak. 150Vrms to 1KHz; 5Vrms to 100MHz.
Power Source	: 110V/220V ± 10% 50Hz/60Hz
Accessires	: Test lead GTL-101 x 2 Instruction manual x 1
Dimension	: 237 (W) x 85(H) x 284(D) m/m
Weight	: 2.5Kg

3. OPERATION INSTRUCTIONS

This section covers preparations, handling precautions panel operation, and operating instruction when performing frequency, frequency ratio, period, time interval, totalize measurements with the instrument. Always strictly observe all operating precautions when using the instrument.

3-1 General preparations and precautions prior to use

1. Before connecting to ac line power, insure that the instrument is in the proper configuration for your power requirements. A label on the rear panel of the instrument indicates which ac line voltage is required.
2. The maximum input voltage which can be applied to the input depends on the frequency and the position of the SENSITIVITY switch. This relationship is shown in Fig. 3, and the values given in this table must be strictly observed. Initially set SENSITIVITY to 1/10, if the counter doesn't count, set switch to 1/1 range and then perform measurement. This procedure will reduce the danger of damaging the input circuit.

3. Use the instrument within an ambient temperature range of 0 – 50°C. Don't place the counter on top of high temperature equipment and be careful not to block the ventilation of instrument.
4. Never permit water to enter the interior of the Instrument and never subject the instrument to severe mechanical shock.
5. When used in especially noisy environments, insert a noise filter into the power source.
6. When the instrument is mounted in a motor vehicle since the mainframe is grounded (power source minus side), use a vehicle having a minus ground.
7. Where low frequencies are measured a low pass filter as illustrated in fugire 1. can be inserted in the line to attenuate high frequency components which may cause false triggering.

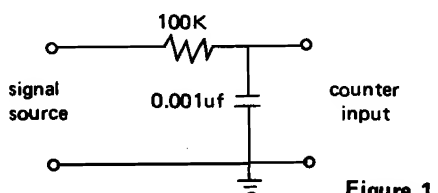


Figure 1

8. Period measurements may be used to determine low frequencies more quickly and accurately than can frequency measurements.

3-2 Explanation of Panel surface

1. INPUT B — Frequency Ratio, Time Interval measurements input terminal, when the FUNCTION range set to F.R. T.I. position. (Other Function doesn't used).
2. INPUT A — Frequency, Frequency Ratio, Time Interval, period, Totalize measurements input terminal.
3. ATTENUATOR SWITCH — Input Sensitivity selector switch, push on is 1/1, push off is 1/10. (CHA only)
4. Range switch — Frequency range selector switch. Push on CHA is 100MHz, CHB is 25 MHz Push off CHA is 10MHz, CHB is 2.5MHz
5. Overflow — Only frequency and totalize measurements will overflow. In case of overflow, eight least significant digits will be displayed and amber front panel overflow LED will be actuated.
6. Display — 8 digit amber LED display
7. FUNCTION INDICATOR LAMP — When push the FUNCTION switch will be indicator the measuring function.
8. FUNCTION SWITCH — For selector measuring FUNCTION.

9. GATE TIME SWITCH For selector measuring GATE TIME.

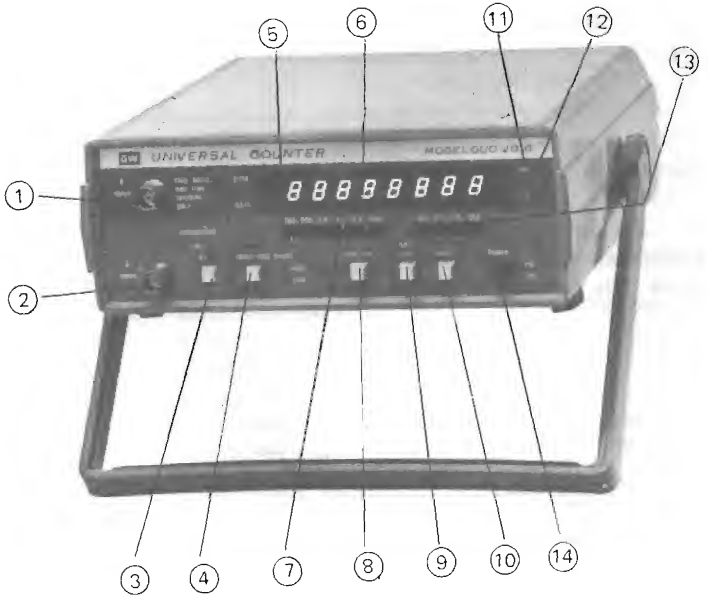
10. RESET SWITCH Reset button clears display, lights all display segments and on release, activates a new measurement.

11. KHz INDICATOR LAMP When Frequency measurements Readout is KHz displayed.

12. uS INDICATOR LAMP When period and Time Interval measurements Readout is uS displayed.

13. GATE TIME INDICATOR LAMP When push the GATE TIME SWITCH will be indicator the measuring gate time.

14. POWER ON/OFF SWITCH Push is ON, pull is OFF.



3-3 Basic measurement instructions

FUNCTION	MEASUREMENT	RANGE	INPUT CONNECTION	REMARKS
FREQUENCY	0.1H–10MHz	10MHz	CHA	
	10 –100MHz	100MHz		
PERIOD	0.1Hz–2.5MHz	10MHz	CHA	
	2.5MHz–25MHz	100MHz		
FREQ. RATIO	0.1Hz–10MHz (CHA)	10MHz	CHA and CHB	
	10MHz–100MHz (CHA)	100MHz		
	0.1Hz–2.5MHz (CHB)	2.5MHz		
	2.5MHz–25MHz (CHB)	25MHz		
TIME INTERVAL	0.1Hz·10MHz (CHA)	10MHz	CHA and CHB	
	0.1Hz–2.5MHz (CHB)	2.5MHz		
TOTALIZE	0.1Hz–10MHz	10MHz	CHA	

4. APPLICATIONS

4-1 Maximum input voltage

The maximum input voltage Vs frequency characteristics is shown in Fig. 3.

4-2 Frequency measurements

This fundamental measurement is perfórmed by totalizing the number of input cycles or events for precisely known period of time. The total count that results is proportional to the unknown frequency, and logic circuits internal to the counter position the decimal point such that the display directly indicates the input frequency, the time reference is usually derived from a precision quartz oscillator internal to the counter.

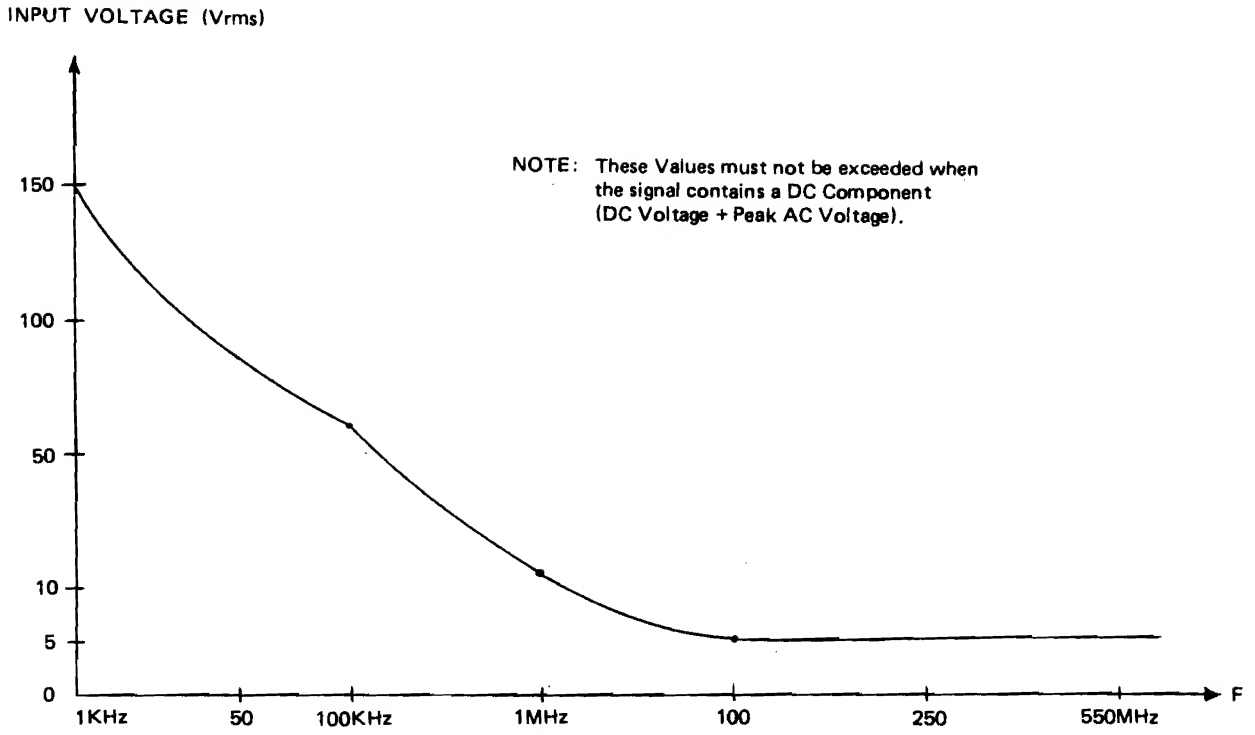


Fig. 3 Maximum input Voltage frequency

4-3 Period measurements

This inverse of frequency capability is sometimes offered to provide to user with high resolution low frequency measurements in digital systems a Period measurement represents the average bit to bit time of the input signal.

4-4 Frequency ratio measurements

The ratio between two input frequencies is a measurement that is also offered by some counters. The major application for ratio is measurement of harmonically related signals.

4-5 Time interval measurement

The measurement of the time between two events or the time between two points on a common event, commonly referred to as time interval is of major importance and is used in wide variety of applications.

4-6 Totalize measurement

The measurement is similar to frequency except that the user now controls the time over which the measurement takes place. With digital systems becoming more prevalent, this fundamental measurement assumes considerable importance.

5. CIRCUIT DESCRIPTION

5-1 Frequency measurement accuracy

Frequency measurement accuracy is determined by the following two items:

1. ±1 count
2. time base accuracy

The ±1 count error is inherent to digital meters and is produced by the phase relationship between the gate signal and the input signal. This relationship a shown graphically in Fig. 4. The counted result is increased or decreased by 1 count depending upon the phase difference. The time base accuracy of the time base oscillator.

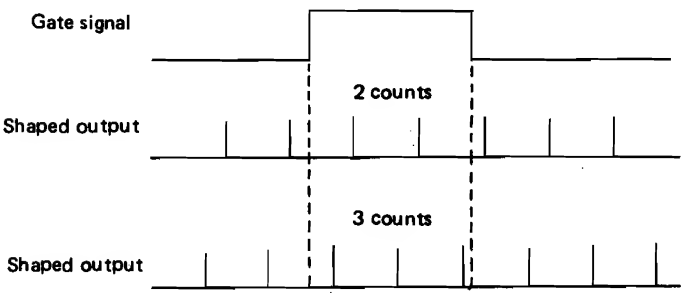


Fig. 4 ±1 count error

To perform high accuracy measurement

The accuracy of the time base oscillator is almost completely determined by the characteristics of the crystal oscillator. The characteristics of the crystal oscillator used in this instrument are described in detail. The specifications of the time base are regiven here.

Oscillation frequency	10MHz
Aging rate	1×10^{-6}/Month
Termperature stability	5×10^{-6} (25±5°C)
	$\pm 2 \times 10^{-5}$ (calibration ambient temperature 0-40°C)

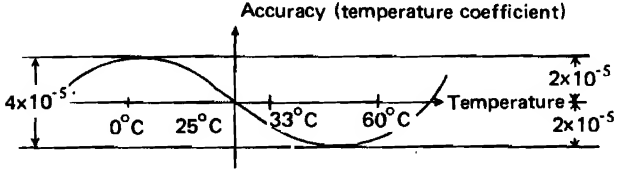


Fig. 5 Tempersture characteristics of the crystal oscillator (worst case conditions)

5-2 Waveform for Guarateed Minimum F_A max and F_B max

1. FIG. 6 For Frequency ratio, totalize measurements Waveform of the LSI input

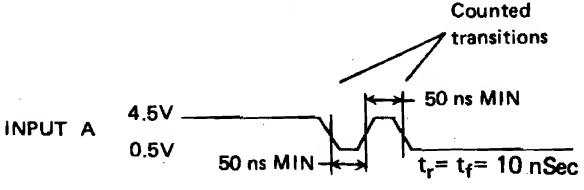


Figure 6. Waveform for Guaranteed Minimum FA MAX

2. FIG. 7 For period and Time Interval measurements Waveform of the LSI input

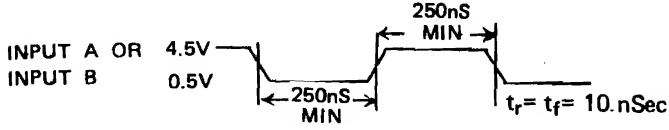


Figure 7. Waveform for Guaranteed Minimum FB MAX

5-3 Time Interval Measurements

This Instrument can be used to accurately measure the time interval between two events. With a 10MHz timebase crystal, the time between the two events can be as long as ten seconds. Accurate resolution in time interval measurement is 100nS.

The feature operates with Channel A going low at the start of the event to be measured followed by Channel B going low at the end of the event.

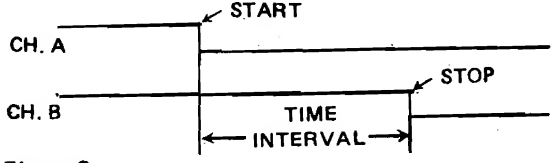


Figure 8.

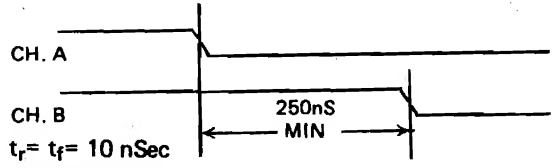
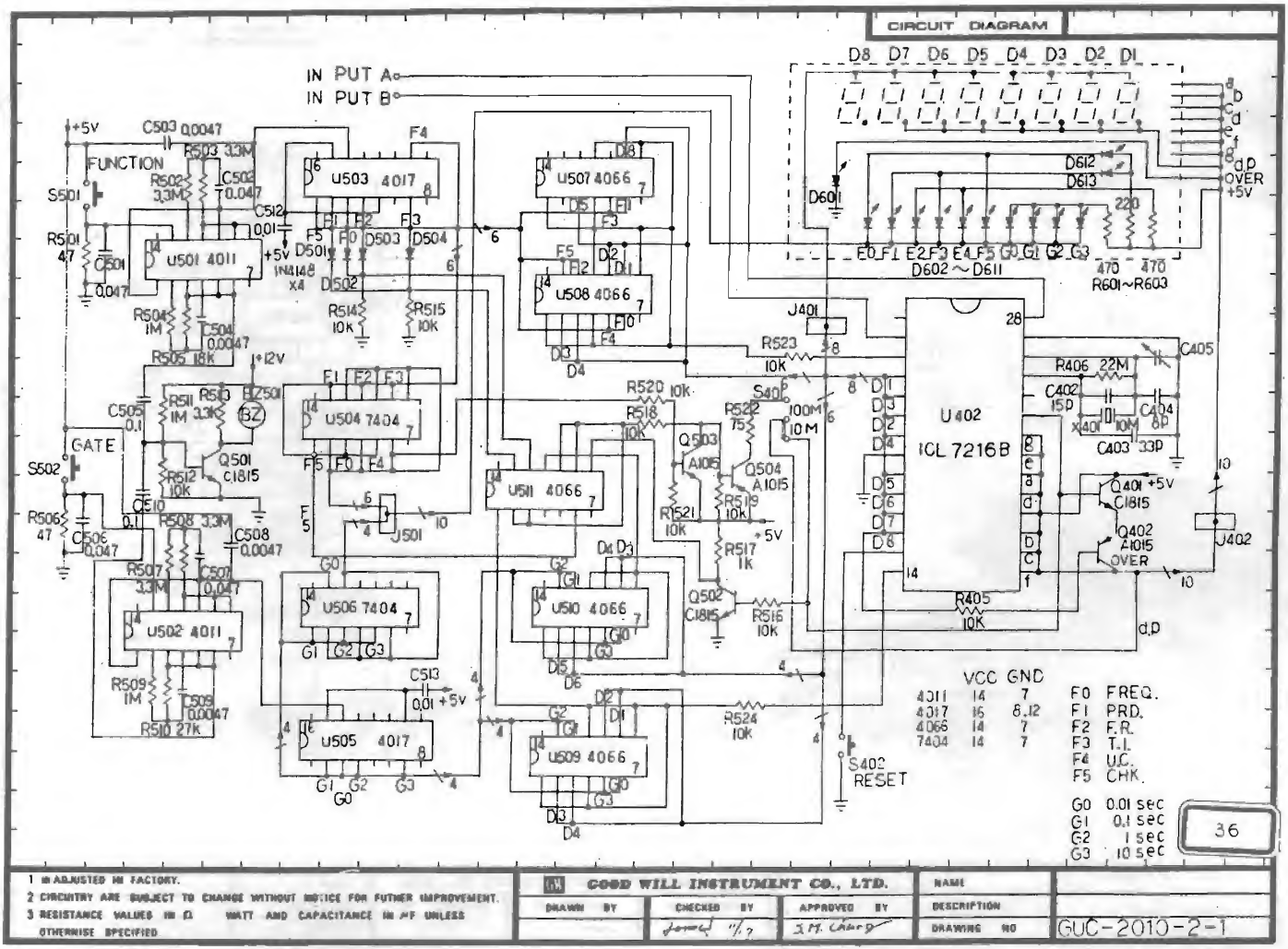


Figure 9. Waveform for Minimum Time Between Transition of Input A and Input B.


CIRCUIT DIAGRAM
IN PUT A
IN PUT B
FUNCTION
GATE
S501
S502
S402
RESET
U501 4011
U502 4011
U503 4017
U504 7404
U505 4017
U506 7404
U507 4066
U508 4066
U509 4066
U510 4066
U511 4066
U402
ICL 7216B
D8 D7 D6 D5 D4 D3 D2 D1
D601
D602 ~ D611
D612
D613
a b c d e f g d.p
OVER +5V
R601~R603
470
220
J401
J501
Q401 C1815
Q402 A1015
Q501 C1815
Q502 C1815
Q503 A1015
Q504 A1015
VCC GND
4011 14 7
4017 16 8,12
4066 14 7
7404 14 7
F0 FREQ.
F1 PRD.
F2 F.R.
F3 T.I.
F4 U.C.
F5 CHK.
G0 0.01 sec
G1 0.1 sec
G2 1 sec
G3 10 sec
36
1 ⊞ ADJUSTED IN FACTORY.
2 CIRCUITRY ARE SUBJECT TO CHANGE WITHOUT NOTICE FOR FUTHER IMPROVEMENT.
3 RESISTANCE VALUES IN Ω WATT AND CAPACITANCE IN μF UNLESS OTHERWISE SPECIFIED
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APPROVED BY
NAME
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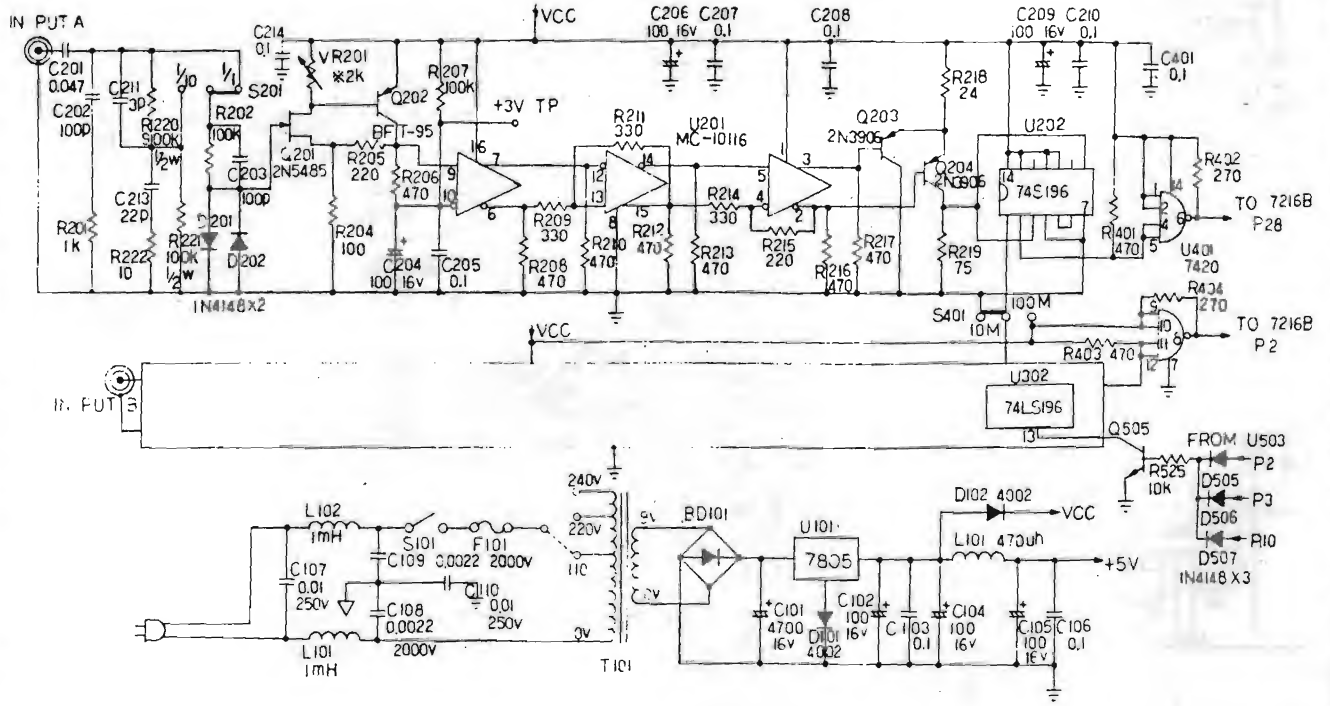
CIRCUIT DIAGRAM



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1 * ADJUSTED IN FACTORY.
2 CIRCUITRY ARE SUBJECT TO CHANGE WITHOUT NOTICE FOR FUTHER IMPROVEMENT.
3 RESISTANCE VALUES IN Ω ¼ WATT AND CAPACITANCE IN μF UNLESS OTHERWISE SPECIFIED

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GOOD WILL INSTRUMENT CO., LTD.

NO. 18, LANE 54, CHUNG-CHENG RD., HSIN TIEN CITY
TAIPEI HSIEN., TAIWAN.
TEL: (02) 917-9188 (15 LINE)
TELEX: 32518 GWINST
FAX: (02) 917-9189